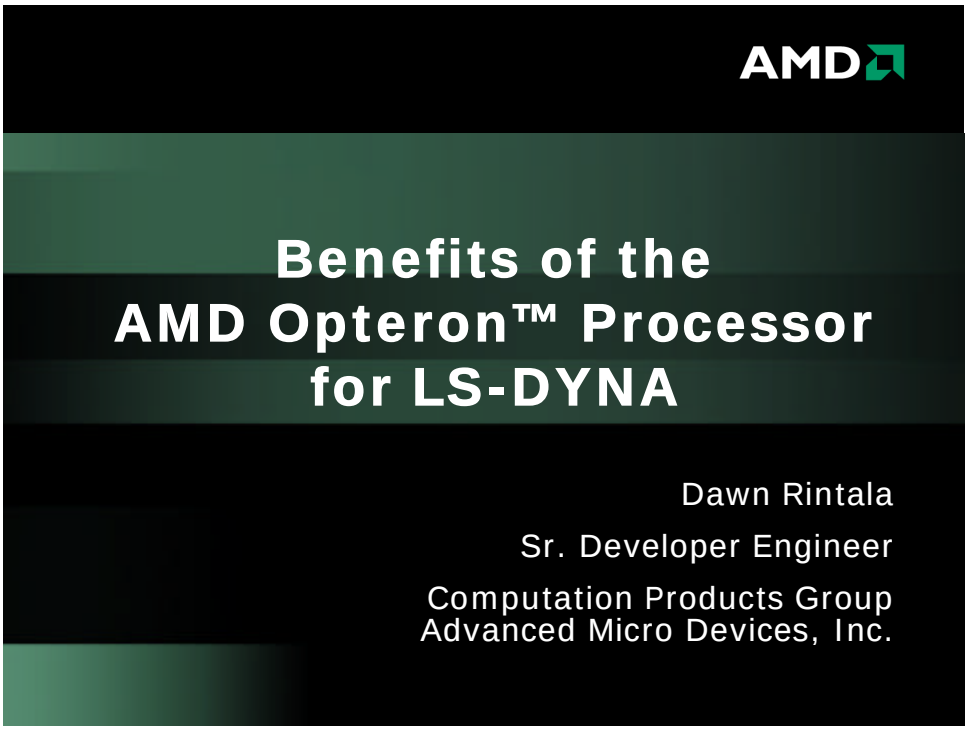


Demands on System from Explicit/Implicit Analysis

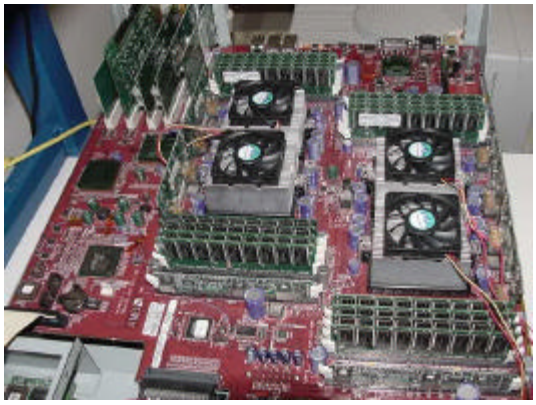
AMD

- **Explicit**
  - **Quick Communication between processors**
  - **Good FPU**
- **Implicit**
  - **Low memory latency**
  - **High memory bandwidth**

AMD Opteron™ delivers:
1. Breakthrough 64-bit performance
2. Complete 32-bit compatibility
3. Industry leading price/performance

Benefits of AMD Opteron™ for LS-DYNA

- Performance
  - Raw Performance
  - Price Performance
- Scalability
  - On-Chip Cache
  - HyperTransport™
- Low Memory Latency
- Memory Addressability

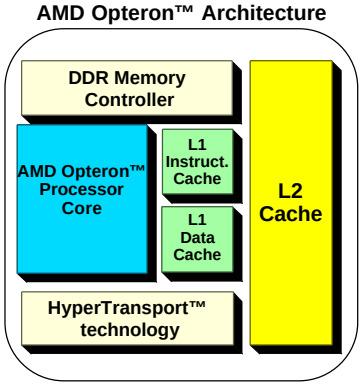


4P, 32GB AMD Opteron™ Processor-based System

AMD Opteron™ SOC Architecture Overview

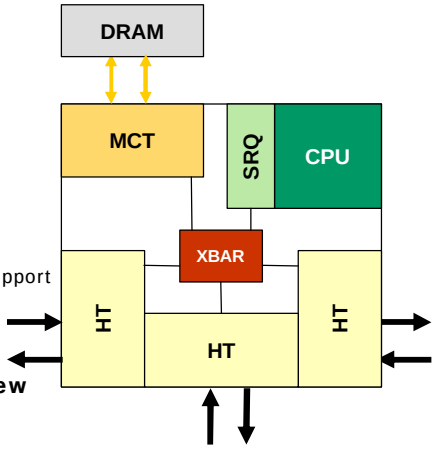
- First AMD64 processor
- Aggressive out-of-order, 9-issue superscalar processor
- Integrated DDR memory controller
- Leading performance in integer, floating point and multimedia
  - AMD64, x87, MMX™, 3DNow!™, SSE, SSE2
- Glueless multiprocessing through HyperTransport™
- Expandable IO through HyperTransport

AMD Opteron™ Architecture



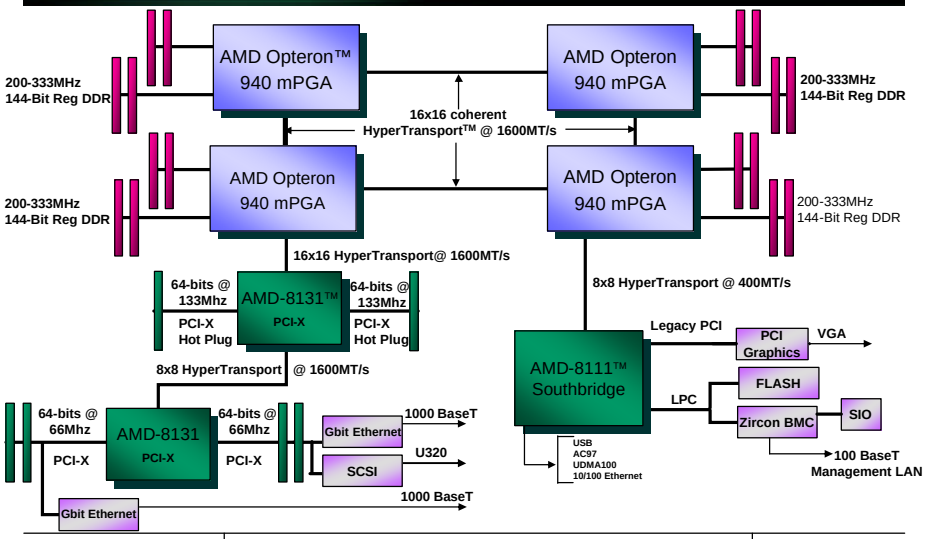
AMD Opteron™ Processor Technology Overview

- **Processor Core Overview**
  - Support for AMD's 64-bit technology
  - 12-stage int, 17-stage fp pipelines
  - Enhanced TLB structures
  - TLB flush filter
  - Enhanced branch prediction
  - 1MB L2 cache
  - ECC protection
- **Memory Controller Overview**
  - Dual-channel DDR memory
  - PC2700, PC2100, or PC1600 DDR memory support
  - Registered or Unbuffered DIMMs
  - ECC and Chip Kill
  - High bandwidth (up to **6.4GB/s**)
- **HyperTransport™ Technology Overview**
  - One, two, or three links
  - 2, 4, 8, 16, or 32-bits full duplex
  - Up to 6.4 GB/s bandwidth per link
  - **19.2 GB/s** aggregate external bandwidth



HT = HyperTransport™ technology

AMD Opteron™ processor-based 4P Server

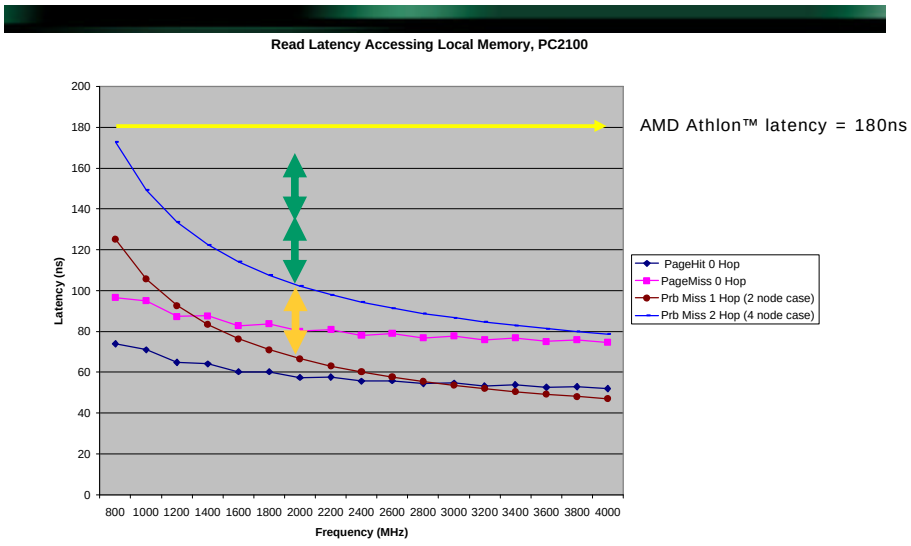


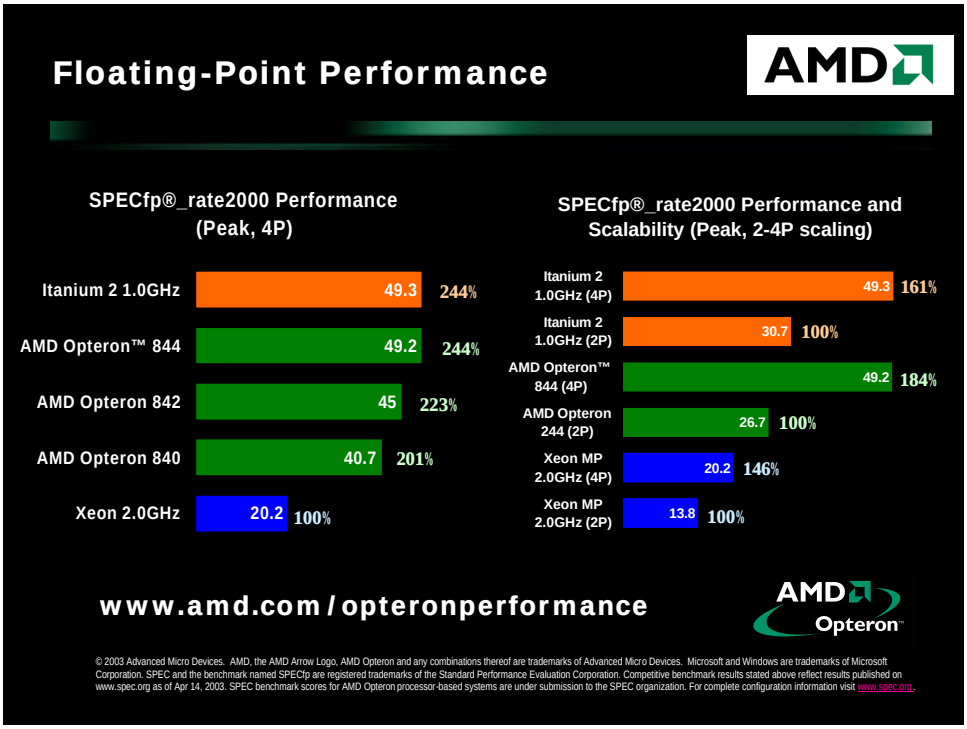
The Rewards of Good Plumbing

- **High Bandwidth**
  - 2P system is designed to achieve 7 GB/s aggregate memory Read bandwidth
  - 4P system is designed to achieve 10 GB/s aggregate memory Read bandwidth
- **Low Latency**
  - Average 2P unloaded latency (page hit) is designed to be < 120 ns
  - Average 4P unloaded latency (page hit) is designed to be < 140 ns
  - Latency under load increases slowly due to excess Interconnect Bandwidth
  - Latency shrinks quickly with increasing CPU clock speed and HyperTransport™ link speed

Integrated Memory Controller

Latency (Local Memory Access, Registered Memory, CAS2)





The Result

AMD

AMD Opteron™ delivers:

1. Breakthrough 64-bit performance
2. Complete 32-bit compatibility
3. Industry leading price/performance

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